What is claimed:

1. A crystal having holograms stored in layers therein comprising:

a cylindrical crystal body formed about an axis and having polished flat end faces and a cylindrical periphery;

annular arrays of holograms stored in the crystal, the annual arrays of holograms being stacked in layers within the crystal.

2. The crystal of claim 1 wherein each annular array of holograms comprises individual holograms separated by an angle in the range of 2° to 6 x $10^{-4}$ radians.

3. The crystal of claim 2 wherein the number of holograms or annular array is in the range of at least 200 to 10,470.

4. The crystal of claim 1 wherein the crystal is a 4mm symmetry photorefractive crystal polished into a cylindrical disk and having a c-axis perpendicular to the plane of the disk.

5. The crystal of claim 1 wherein the crystal is a 3m symmetry photorefractive crystal polished into a cylindrical disk with a c-axis perpendicular to the plane of the disk.

6. The crystal of claim 1 wherein the crystal is formed of a crystallizing material selected from the group consisting of lithium niobate and lithium tantalate.

7. The crystal of claim 1 wherein the crystal is configured as a rod having an axially length greater than its diameter wherein a plurality of annular rays of holograms are stacked to form a hologram package having an axial length greater than its diameter.

8. A method of storing data in the form of holograms in a crystal, comprising;

providing a cylindrical crystal formed about an axis, the crystal having an axially facing surface and a peripheral surface extending transverse to the axially facing surface;

from a source of laser light, providing a signal beam containing the data and focusing the signal beam through the axially facing surface of the cylindrical crystal;

from a source of laser light, providing reference beam and focusing the reference beam through the peripheral surface of the cylindrical crystal to interfere with the signal beam and thereby write a hologram in the cylindrical crystal, and

rotating the cylindrical crystal about the axis thereof to write additional holograms in the cylindrical crystal in an annular array.

9. The method of claim 8 further including indexing the crystal axially with respect to the beams to write an additional annular array.

10. The method of claim 9 further including indexing the crystal axially with respect to the beams to write numerous annular arrays stacked axially within the crystal.

11. The method of claim 10 further including reading the hologram out of the crystal by passing a reference beam therethrough to diffract from the holograms and produce a diffracted beam including the data of the holograms, and including reading the diffracted reference beam with a detector.

12. The method of claim 11 wherein the transmitted reference beam is converted to a phase conjugate beam that diffracts from the hologram and is read by the detector.

13. The method of claim 8 further including reading the hologram out of the crystal by passing a reference beam therethrough diffract from the holograms and produce a

diffracted reference beam including the data of the holograms and reading the diffracted reference beam with a detector.

14. The method of claim 13 wherein the defracted reference beam is converted to a phase conjugate beam before being read with the detector.

15. An apparatus for writing holograms into a cylindrical crystal formed about an axis, comprising:

a source of laser light passing through a polarizing device;

a beam splitter dividing the laser light into a reference beam and a signal beam;

an optical path for directing the reference beam into the crystal in a radial direction with respect to the axis of the crystal; and

an optical path for directing the signal beam through an SLM and into the crystal in an axial direction with respect to the axis of the crystal for interference with the reference beam to store holograms within the crystal.

16. The apparatus of claim 15 further including a support for the crystal, the support including a motor for rotating the crystal about the axis to write angularly spaced holograms therein.

17. The apparatus of claim 16 further including an axial translator associated with the support for moving the crystal axially to write holograms in layers axially spaced with respect to one another.

18. An apparatus for reading holograms into a cylindrical crystal formed about an axis, comprising:

a source of laser light passing through a polarizing device;

an optical path for directing a reference beam into the crystal in a radial direction with respect to the axis of the crystal for interference with the holograms within the crystal to direct images of the holograms axially out of the crystal, and

a detector positioned to receive the axially directed images.

19. The apparatus of claim 18 further including a support for the crystal, the support including a motor for rotating the crystal about the axis to read angularly spaced holograms therein.

20. The apparatus of claim 19 further including an axial translator associated with the support for moving the crystal axially to read holograms in layers axially spaced with respect to one another.

21. The apparatus of claim 20 wherein the detector is a charge coupled device.

22. The apparatus of claim 21 wherein the images of the holograms are coupled to the detector by a mirror reflecting the images transversely to the axis through a lens for focusing into the charge coupled device.

23. The apparatus of claim 21 further including a phase conjugate mirror positioned radially of the crystal to produce a phase conjugate beam that propagates back along the axis of the crystal and for detection by the charge coupled device.